

having at one end the displacement of the bands, and at the other the energy in the sound.

Besides all the various physical and physiological problems before mentioned in this paper, whose data may be obtained in permanent records, some additional ones may be attacked with this photographic apparatus. For instance, it will be of interest to know why the same note on two different musical instruments, e. g., violin and flute, should be so different in quality. The comparison of photographs of these sounds would answer the question. Similarly we may investigate the physical peculiarities of any sound produced by man or in nature.

RAINFALL AND TEMPERATURE IN NICARAGUA.

By A. P. DAVIS, Hydrographer, United States Geological Survey.

The Nicaragua Canal Commission made certain investigations of the climatology of Nicaragua in 1898. Their observations, being confined to data bearing upon the problem of an interoceanic canal, did not include barometric investigations. Rainfall, temperature, and humidity observations were made at a number of stations, mostly in the vicinity of the proposed canal line, and well distributed between the Atlantic and Pacific. The form of rain gage used at most of the stations was a metal funnel, which caught the rain and discharged it into a bottle, from which it was measured in a graduated glass bearing a known relation to the diameter of the funnel. The gage was always placed in a position as exposed as possible; but nearly always this was a small clearing in the forest, which was still well sheltered from the wind.

One of the most remarkable characteristics of Nicaragua is its rainfall and the radical and striking differences in amount and distribution of precipitation on the east and west coasts. From the rainfall tables it will be seen that at Greytown, on the Rio Deseado, and other points near the Atlantic there is no definite dry season, but that rain may be expected any day in the year, and the expectation will seldom be disappointed. On the Pacific coast, on the contrary, there is no rain from the beginning of the record in January until the middle of May, when the rainy season begins, after which it is subject to violent downpours throughout the rainy season, the precipitation for a single day observed at Brito, on the 23d day of May, being 5.06 inches.

No less remarkable is the excessive aggregate of rainfall in a limited district of which the nucleus seems to be in the vicinity of Greytown. The annual rainfall at this point, as deduced from the mean of four years' observation, is about 250 inches, while that at Bluefields is only about 90 inches, at Port Limon somewhat less, and at San Jose de Costa Rica about 68.

While there is a slight increase of rainfall with altitude at the headwaters of the Deseado and San Francisco, yet, in general, it may be said that the rainfall decreases as we pass up the San Juan River. No definite limit can be assigned, with present information, to this district of excessive rainfall, nor is it known in what ratio precipitation decreases to the northward and southward.

The dividing line between the characteristic climates of the east and west is not definite, but may be said, in general, to approximately coincide with the range of mountains known in canal literature as "the Eastern Divide." The portion west of this divide partakes of the characteristics of the Pacific slope, having a comparatively moderate precipitation and a definite division of rainy and dry seasons, while the territory east of this divide has no well-defined dry season and has much heavier rainfall than the west side. The exception to this rule is the valley of the San Juan. As we proceed up this river the rainfall decreases rapidly and almost uniformly, but the dry season is by no means well defined and rain may be expected in any month.

Thus, so far as quantity and distribution of rainfall alone is concerned, the conditions are rather unfavorable to the requirements of the canal. The heaviest engineering constructions are to be on the east side, where the rain is excessive and persistent, thus interfering with construction and with the permanence of the works. On the other hand, the entire basin of Lake Nicaragua, upon which the canal must depend for its water supply, is affected by a long, dry season, in which evaporation from the lake is greatly in excess of the inflow, and storage must be provided to overcome this drain.

On the west side, including the basin of Lake Nicaragua, the dry season begins in December and ends in May—being ordinarily from one to two months shorter than the rainy season. During the latter part of the dry season the inflow to the lake becomes very slight, many of the tributaries, though wide and deep, are filled with stagnant water, upon which grows enormous masses of floating vegetation, which discolors the water, renders it foul, and obstructs navigation. When the rains begin in May or June these streams are swollen to almost torrential proportions and flow with strong currents far out into the lake, carrying great masses of vegetation or floating islands, sometimes acres in extent, which form large crescents around the mouths of the streams and become a source of serious annoyance to the steamers plying on the lake. These floating islands are eventually broken up by the winds and waves of the lake, and such parts as are not discharged through the San Juan River decay in the lake.

Records of rainfall for numerous stations in Nicaragua were published by Mr. A. J. Henry in the MONTHLY WEATHER REVIEW for July, 1898, pages 304-306. Since that date some additional information has been received, making a complete record of nineteen years at Rivas and four years at Greytown. The Rivas record is from 1880 to 1898, inclusive, and the Greytown record is for the years 1890, 1891, 1892, and 1898. The contrast of climatic conditions on the two sides of the Isthmus is further illustrated by an examination of these records. The year 1890 shows the smallest precipitation of any of the nineteen years recorded, being only 31.80 inches, while in the same year 296.94 inches fell at Greytown, this being the maximum observed at that point. In the year 1898 the precipitation at Greytown was 201.64 inches, the lowest in the record, while at Rivas in that year 108.06 inches fell, this being one of the highest in the Rivas record. These facts suggest that perhaps there is a compensating influence at work and that the same cause which produces a year of small precipitation on one side operates in the reverse direction on the other.

Monthly rainfall in Nicaragua during 1898.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Brito .....	.25	.00	.08	.08	11.30	14.96	11.42	6.18	16.82	25.70	6.01	2.41	95.11
Las Lajas .....	.35	.05	1.34	.28	10.60	13.50	10.64	8.44	6.79	16.19	4.41	2.26	74.75
Rio Viejo .....	.04	.01	.66	.00	13.79	13.45	4.01	11.66	7.28	8.99	0.61	0.17	60.66
Tipitapa .....	.26	.00	.26	.00	8.56	16.88	6.24	7.82	11.25	7.12	0.98	0.17	59.49
Morrito .....				.07	8.92	14.05	18.84	10.20					
Fort San Carlos			1.21	8.00	8.22	15.56	13.35	8.00	10.58	8.98	9.98	5.82	84.31
Sabalos			2.10	6.00	11.69	17.13	20.69	11.33	11.42	11.81	12.17	10.20	104.54
Castillo					18.92	11.46	16.22	15.22	2.99	14.04	11.64		
Machuca					6.52	12.98	9.83	15.65					
Rio San Carlos			7.52	11.67	30.18	20.73	18.26	11.68					
Ochoa	13.07	14.07	8.04	12.22	15.24	21.44	21.58	12.06	15.12	8.02	21.50	8.88	170.74
San Francisco*	15.33	18.43	8.72	11.25	13.87	18.97	19.22	13.45	10.98	9.09	22.38	10.61	172.17
Sarapiquí									11.19	11.35	18.63	7.12	
Deseado†	21.92	26.98	11.76	8.83	14.84	18.66	26.86	13.31	5.28	11.92	29.25	21.07	210.63
Greytown	19.44	25.17	10.16	7.82	9.37	19.52	24.63	16.38	7.94	12.50	32.35	17.06	201.64

* Record incomplete from January 1 to 5, inclusive, and from December 29 to 31, inclusive, so the rainfall at Ochoa for those days is added.

† Rainfall not observed from December 25 to 31, inclusive, so the record was completed by including the corresponding days for 1897.

TEMPERATURE AND RELATIVE HUMIDITY.

The temperature of Nicaragua is remarkably uniform.

While some of the higher mountain regions have a rather cool climate, there is never any frost, and in general it may be said that in the habitable region of the republic the temperature seldom exceeds 90° Fahrenheit or falls below 70°, and in any given locality the annual fluctuation is sometimes still less. The relative humidity is high in all of the uniformly high temperatures, excepting during the dry season on the west side of the isthmus.

Observations of wet and dry bulb thermometers were carried on at the station on the Rio Grande, at Las Lajas, Rio Viejo, Fort San Carlos, Sabalos, Rio San Carlos, Ochoa, Deseado, and at Greytown, and the results are given in the following tables.

Temperature and relative humidity at Las Lajas, on western shore of Lake Nicaragua, 1898.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
February.....	80	75	77.7	81.1	August.....	88	74	80.7	87.0
March.....	82	78	79.5	79.3	September.....	88	73	79.4	90.4
April.....	88	77	80.8	79.1	October.....	88	73	79.3	89.7
May.....	91	78	82.1	83.0	November.....	88	73	78.3	91.1
June.....	91	78	81.4	84.8	December.....	88	73	78.3	91.1
July.....	88	74	79.7	86.6					

Temperature and relative humidity at station on Rio Viejo, at crossing of Matagalpa Leon road, 1898.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
February.....	80	75	77.7	81.1	June.....	94	70	80.6	81.4
March.....	82	78	79.5	79.3	July.....	88	70	78.8	79.6
April.....	88	77	80.8	79.1	August.....	90	71	78.4	83.1
May.....	91	78	82.1	83.0					
June.....	91	78	81.4	84.8					
July.....	88	74	79.7	86.6					

Temperature and relative humidity at St. San Carlos, on eastern shore of Lake Nicaragua, 1898-99.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
March, 1898.....	88	70	78.1	89.5	September.....	90	73	79.6	87.3
April.....	88	70	78.5	79.1	October.....	90	74	79.1	88.5
May.....	91	75	80.0	85.9	November.....	88	73	77.9	90.1
June.....	90	75	79.5	88.9	December.....	88	70	76.5	88.8
July.....	90	73	78.2	88.9	January, 1899.....	84	69	75.9	90.5
August.....	89	72	79.3	89.5					

Temperature and relative humidity at Camp Sabalos, on San Juan River ½ mile above Torro Rapids, 26 miles from Lake Nicaragua, 1898-99.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
February, 1898.....	90	67	73.5	87.9	August.....	87	70	77.5	91.0
March.....	90	68	73.7	84.3	September.....	90	71	78.6	87.4
April.....	88	68	73.8	85.3	October.....	90	71	78.2	87.4
May.....	88	71	77.8	93.8	November.....	88	68	77.0	89.4
June.....	88	71	77.7	90.0	December.....	88	68	75.6	89.0
July.....	88	71	77.1	92.0	January, 1899.....	86	66	73.2	90.7

Temperature and relative humidity at Ochoa, on San Juan River, 40 miles from Caribbean Sea, 1898.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
January.....	88	68	73.9	91.6	July.....	89	70	78.6	91.5
February.....	88	68	73.3	90.4	August.....	87	70	77.0	91.4
March.....	87	67	73.1	87.6	September.....	91	70	77.5	89.6
April.....	88	68	75.8	88.8	October.....	95	71	71.2	89.4
May.....	94	73	78.3	90.0	November.....	89	70	76.1	91.0
June.....	86	71	77.5	90.7	December.....	88	67	75.1	91.0

Temperature and relative humidity at station on Deseado River, 10 miles from Caribbean Sea, 1898.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
January.....	86	65	74.1	94.7	July.....	85	73	78.1	89.2
February.....	84	66	74.1	90.2	August.....	87	73	78.3	91.8
March.....	87	68	77.3	84.7	September.....	91	73	79.8	88.8
April.....	87	67	78.8	85.2	October.....	89	72	79.5	88.8
May.....	91	73	79.5	89.4	November.....	98	71	76.8	84.8
June.....	86	73	78.9	91.0	December.....	84	66	76.1	94.0

Temperature and relative humidity at Greytown, Nicaragua, 1898.

Month.	Temperature.			Mean relative humidity.	Month.	Temperature.			Mean relative humidity.
	Maximum.	Minimum.	Mean.			Maximum.	Minimum.	Mean.	
January.....	86	67	77.5	82.5	July.....	90	74	80.0	91.3
February.....	84	71	77.1	81.7	August.....	96	73	80.0	84.9
March.....	90	69	78.4	80.3	September.....	96	73	81.2	85.0
April.....	88	69	79.9	79.0	October.....	96	73	81.4	84.8
May.....	94	73	80.4	82.1	November.....	92	72	79.7	87.7
June.....	90	73	79.8	91.4	December.....	91	72	78.3	88.0

NOTES BY THE EDITOR.

THE PACIFIC COAST DIVISION OF THE CANADIAN METEOROLOGICAL SERVICE.

Referring to an article by the Editor on page 102 of the MONTHLY WEATHER REVIEW for March, the reader will notice that we spoke only of the proposed system of daily forecasts that now emanate from the Central Office of this Division, at Victoria, B. C. But in addition to the forecasts, we are also interested in the general development of meteorological work

in that section. On this point Professor Stupart informs us that—

Since July, 1890, Mr. Baynes Reed has been in charge of the Canadian meteorological chief station on the Pacific coast. Last year his station was moved from the suburb of Esquimalt to the City of Victoria and became the head office of the Pacific Division of the Canadian service with Mr. Baynes Reed still in charge. Mr. F. Napier Denison, late of the Toronto office, has been assigned as his assistant. Mr. Reed has been indefatigable in his endeavors to secure volunteer observers in British Columbia, and to his labors, combined with the valued coop-